

From: Kooij & Van Veen (Eds)  
Teacher Learning Net Matters  
Interconnected Perspectives  
Newcastle (2012)

# 1 What Makes Teacher Professional Development Effective?

## A Literature Review

Klaas van Veen, Rosanne Zwart  
and Jacobienne Meirink

## INTRODUCTION

This chapter aims to explore what is currently known about the effectiveness of teachers' professional development (PD) programs or PD interventions on the quality of teachers, their teaching and student learning. *PD activities* refer to a wide range of activities in which teachers participate, such as information meetings, study days, 1-day workshops and training sessions; coaching and intervention; mentoring, classroom observations, participation in a network, offsite team training sessions, book and study clubs; and research projects. Most of the current PD activities can be characterized as traditional forms of PD. *Traditional* refers to the way PD was organized for the last decades: mainly through lectures, 1-day workshops, seminars and conferences, which were not situated at the workplace, in which teachers played a passive role, and in which the content was not adjusted to the problems and issues in the daily teaching practice. *Innovative forms* refer to all those interventions in which teachers do play an active role, and the issues in their own teaching practice determine the content. Some examples are collaboration of colleagues, study and book clubs, mentoring, coaching, intervention and research by teachers. It also includes the discourse on professional learning communities in which the emphasis is on the collective responsibility of teachers for the learning of their students and insights on teaching and PD (see also the chapter of Judith Warren Little in this volume; Borko, Jacobs & Koellner, 2010).

The distinction between traditional and innovative is rather normative in the sense that innovative would be better than traditional, even although empirical evidence for this assumption is still missing, as will be shown in this review. Besides, traditional forms are still used on a large scale, although there is also an increase of mixed forms. The current discourse views PD as more effective if the teacher has an active role in constructing knowledge and collaborates with colleagues, the content relates and is situated in the daily teaching practice and the possibilities and limitations of the workplace are taken into account. However likely, these assumptions

lack empirical evidence. Therefore, it is relevant to review what is currently known empirically on effective features of divergent PD interventions and on the school organizational conditions to successfully implement these interventions. So, the following questions guide the review study:

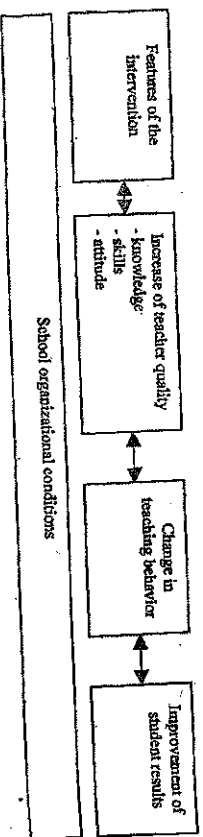
1. What is known about the effective features of interventions for PD?
2. What is known about the school organizational conditions of these PD interventions?

## THEORETICAL FRAMEWORK

Teacher PD in this chapter refers to those processes and activities designed to enhance the professional knowledge, skills and attitudes of educators so that they might, in turn, improve the learning of students (Guskey, 2000). The focus of the review are those activities explicitly designed for PD of teachers, which we describe as interventions for PD. More specifically, the focus is on those studies that report about effective features of PD.

When, however, is PD effective? Assuming the only relevant indication is increased student results, studies should focus on the relationships between the intervention and student results. If improving teacher behavior or teacher knowledge is the main goal of PD, then the focus should be relationships between the intervention and teachers' behavior or knowledge. However, if the assumption is that a change in behavior is always the result of a change in cognition, the focus should be the relationships between the intervention and the cognition, and perhaps also on teacher behavior. The same applies to the assumption that student results are the result of a change in teacher behavior or teacher cognition. Given different aims and change in teacher behavior or teacher cognition. Given different aims and assumptions behind concepts of PD effectiveness, it is essential to formulate the model this review uses to understand the effectiveness of PD.

As a main theoretical and organizing frame, this study applies Desimone's (2009) conceptual model for studying the effects of PD on teachers and students, based on an extended literature review. The model demonstrates of interactive, nonrecursiveness relationships between (a) the critical features of PD, (b) teacher knowledge and beliefs, (c) classroom practice and (d) student outcomes (see Figure 1.1).



## What Makes Teacher Professional Development Effective? 5

The relationships between these elements are not linear per se, as often is the case, rather as integrated and dynamic (cf. Clarke & Hollingsworth, 2002). For instance, research shows that a change in teaching behavior can be caused as much by a change in teacher knowledge as a change in student behavior (Guskey & Sparks, 2004). Rather, it is essential to articulate the relationships between the different elements, which can be described as the 'theory of improvement' (Wayne, Yoon, Zhu, Cronen & Garet, 2008; Desimone, 2009). What is the intervention supposed to do? Who has to learn what, how and why? And what elements will result in an effective PD intervention? This theory of improvement can refer to three aspects: theory of change, theory of instruction and theory of context.

Theory of change refers to the assumed relationships between the features of the PD intervention and the change in teacher knowledge and/or change in instruction. Theory of instruction focuses on student results and refers to the relationships between the features of the PD intervention, the intended changes in teacher knowledge and instruction and the expected changes in student outcomes. Theory of context refers to the school organizational conditions necessary to implement and sustain successful PD in the school or in the classrooms. As Smylie (1995) observed, and more recently Little (2006) and Imanis and van Veen (2010) confirm, most PD research hardly takes the conditions of the daily workplace into account, while these conditions strongly determine the opportunities and limitations of PD interventions.

Measurement is another important factor in effective PD interventions. Despite the recent focus on evidence-based practices, interventions that are hardly explored for their effect still dominate PD practice. As Hartie (2009, p. 2) summarized the general state of educational research on these topics: "[T]he research evidence relating to 'what works' is burgeoning, even growing, under a weight of such beautiful 'try me' ideas." One of the reasons for this lack of evidence is the discussion about what is considered to be evidence.

Some argue that conclusions about causality and effectiveness can only be based on randomized controlled trials (cf. Slavin, 2008; Raudenbush, 2005; Wayne et al., 2008). Others argue that this approach is limited due to the underlying technocratic assumption, in which the effectiveness of the features of the intervention is the only relevant focus. Educational goals, which can strongly differ per school and teacher, can also determine effectiveness (Biesta, 2007). Others, while supporting the evidence-based approach, point to the risk of constructing lists of what works because it might "provide yet another set of recommendations devoid of underlying theory and messages" (Hartie, 2009, p. 3) or neglecting the specific features of the context.

These last issues seem to complicate the debate on effectiveness. Often it is only known what works in general, or only in very specific situations. So Raudenbush (2005) argues that randomized controlled trials are actually

is only valid way to explore effectiveness, but it is not sufficient to understand why what works. Qualitative, small-scale case studies are therefore needed (cf. Little, 2006). And, as Raudenbush (2005) adds, (multiple) case studies are needed to provide working assumptions that can be tested in large-scale studies.

In addition, Verloop (2003, p. 208) notes that besides effectiveness studies, there are all kinds of educational and subject pedagogical theories and notions providing clear and insightful descriptions of educational processes that are the result of systematic thinking and research into teaching and learning. Although this body of knowledge provides no rigid empirical evidence about what works, it can be very relevant for teachers. So, to get an overview of what is known, this review will include both large-scale effectiveness studies and small-scale qualitative studies. The combination of both research approaches enables us to understand when and why and for whom an intervention is effective.

## METHOD

This review focuses on those activities that are explicitly designed for PD of teachers (referred to as PD interventions). An important criterion for inclusion of studies in this review is that researchers examined the effect of the intervention. As described earlier in the theoretical framework, effectiveness can refer to different elements of the analytical framework: teacher quality, teacher classroom behavior and/or student learning.

### Search Strategies and Criteria

Several search strategies were used to accomplish an extended overview of studies on the effect of PD interventions. We conducted literature searches with the use of ERIC, PsycINFO, Dissertation Abstracts, Sociological Collection, PiCARTA and Google Scholar. Furthermore, we examined references of previous reviews. For this process of searching and analyzing a protocol was developed. This protocol included a list of search terms, which was partly based on previous reviews. The most important search terms were: teacher PD, teacher learning, in-service program, learning in the workplace, effects of PD, effective PD and more specific terms referring to learning activities and formats as coaching, mentoring, workshops, seminars, etc.

After an extensive exploration, it appeared that many studies conducted in the past 25 years have been summarized in a large number of review studies. Therefore, we decided to take these review studies as a starting point for the analysis. Next, we researched PD interventions conducted in the past 10 years (2000–2010) in addition to the existing overviews.

For the selection of the additional studies, the following criteria

- The study needs to report on a PD intervention.
- The study needs to report on outcomes with respect to teacher learning or student learning, outcomes for teacher learning as well as student learning or even on the relation between teacher learning and student learning.
- The study has to be published in a peer-reviewed journal, in a dissertation or in a report commissioned by a renowned institute or government agency.
- Both quasi-experimental case studies and quantitative and qualitative studies are included as long as the method was elaborate and transparent enough in order to draw some conclusions about effective features. We based this decision on weighing the methodology and the 'impact' of the results. Studies were scored on: (a) soundness/rigidity of methodology and (b) substantial qualitative or quantitative results.
- The study needs to add to previous studies in such a way that it concerns an intervention that has not been examined yet or it concerns a new design or method.

### Content Analysis of Additional Studies

Based on this first selection, we selected 11 reviews and 95 additional studies on PD interventions. We summarized all studies according to 22 aspects, such as: type of study, context, the content of the intervention, learning goals, 'theory of improvement', the results, school conditions and how it can be placed in the 'conceptual framework.' Of the 95 additional studies it appeared that some studies did not offer enough information to learn more about effective features of the PD interventions. In the end, 34 studies on PD interventions remained for the more detailed analysis.

#### Input of Experts in the Field of Teacher Learning

The aim of consulting various (international) experts in this field was to make sure that no important, not (yet) published or published reports were excluded in this review. In addition, the researchers used these consultants to identify the most relevant studies and to discuss the results and conclusions.

## RESULTS

### A General Overview

The review brings together 11 major reviews and texts and 34 additional empirical studies on effective PD that cover the last 25 years of research on PD interventions. The 11 review texts are: Blank and de las Alas (2009); Borko et al. (2010); Desimone (2009); Hawley and Valli (1999); Kennedy



the majority of the studies concern the relation between the intervention and teacher quality. To a lesser degree there are studies that examine the relation between the intervention and the quality of classroom behavior. Only a limited number of studies focused on the relation between PD interventions and student results (cf. Borko, 2004; Little, 2006; Loucks-Borsley & Matsumoto, 1999; Smith & Gillespie, 2007; Supovitz, 2001). Recently, studies on the relation between interventions, teacher and student outcomes are increasing (for example, Garer et al., 2008; Timperley et al., 2007; Yoon et al., 2007).

### Effect Size

Another problem is that most studies rely on self-reports of teachers (teachers' perceptions on possible effects and not more [quasi-] objective effect sizes like assessments, observations and student test scores). Well-known examples of studies that rely on self-reports are the large-scale studies of Cohen & Hill (2000), Garer et al. (2001) and Kennedy (1998). These studies are cited in many reviews as empirical evidence for the positive effect of PD interventions on teacher quality (cf. Borko, 2004; Little, 2006). A recent exception is the large-scale study of Garer et al. (2008), which includes a 'teacher knowledge assessment' and also extended observations and student-scores (cf. for the limited amount of studies that incorporate student outcomes, Timperley et al., 2007; Yoon, 2007).

Furthermore, in many studies the effect size is too general to define the effects of the PD interventions (Hattie, 2009). In other words, there is incongruence between the goal of the intervention and the effect that is measured. However, studies aimed at measuring more specific effect sizes for a PD intervention are also increasing (as the majority of the 34 additional studies found in this review show).

### Lacking a 'Theory of Improvement'

In PD interventions the 'theory of improvement' often remains implicit. It often lacks a well-thought-out idea of how the form and content of intervention influence teacher learning ('theory of change') or student learning ('theory of instruction'). This is problematic since research on PD intervention does offer lists of effective features but it is not clear in what way these features contribute to the effect of an intervention on teacher or student learning.

### Dominance of Research into 'Traditional' Forms of PD

Another problem is that studies are lacking on the effectiveness of many innovative forms of PD. Most research concerns more traditional forms of

al., 2007; Wayne et al., 2008). Studies into forms of PD at the workplace, like coaching and mentoring, action research, study groups and teacher networks, often focus on the processes that take place during these interventions rather than on their effects.

### Size of Studies

Finally, in research on teacher learning a more general problem can be detected, which was identified by Borko (2004; Borko et al., 2010). There is an overload of (mostly qualitative) studies that examine one program or intervention in one specific setting (type 1 studies in terms of Borko). Fewer studies examine one specific intervention and features in several settings with several coaches (type 2 studies). Largely missing is research in studies featuring several interventions in more than one setting, with several coaches (type 3 studies). The latter two types of research are necessary to draw valid, reliable and generalizable conclusions.

In type 1 studies it is impossible to define which features of an intervention are relevant and in what way. For example, many studies argue that coaching can be effective, but often it is not clear how many hours should be invested in the coaching. The number of hours is important since they require a financial investment that affects the number of hours that are available for working with students.

The general problem, which Borko (2004) and Wayne et al. (2008) point out, is that most of the research on PD interventions is not complete, generalizable, precise or valid enough. In this respect, Wayne et al. discuss the distinction between 'efficacy trials' and 'effectiveness trials.' With 'efficacy trials' they refer to studies that focus on one PD intervention aimed at contributing to the PD of teachers, whereas 'effectiveness trials' comprise studies where PD interventions are tested in numerous diverse settings. The latter type of studies can be highly relevant for developing knowledge about features and effects of PD. In their review of studies on the relation between teacher PD and student results, Yoon et al. (2007) found that only 9 studies of 1,300 studies in total meet these criteria. Regarding the 34 additional studies found in the current review, most are type 1 studies, except for Desimone et al. (2002); Ingrassano et al. (2005); James & McCormick (2009); McCutchen et al. (2002); Saxe et al. (2001); Supovitz & Turner (2000); and Telase (2008).

Apparently, it is impossible to draw rigid conclusions about 'what works' in PD interventions. Nevertheless, Borko et al. (2010, pp. 548-549) argue that there is "a growing consensus within the field regarding the central features of PD that are effective in improving teaching practice" (cf. Wayne et al., 2008). This makes a review on the effects of the different PD interventions less significant compared to a review of what is known about features of effective PD in general. Those features should be regarded as *indications* for what works. This list of features can be used to design, implement and evaluate specific forms of PD.

## Active Features

In the following, we present an overview of effective features based on an analysis of 11 review studies and 34 intervention studies. Features described by Kennedy (1998) form the starting point of the analysis. We then compared the list of these features to other review texts and additional studies and adjusted or complemented.

### *sign: Traditional Versus Innovative*

The distinction between more traditional and more innovative designs of a PD program does not necessarily seem meaningful when distinguishing between effective and ineffective PD programs. This is because empirical research underpinning that one design is more effective than the other design is still lacking. Although there is a growing consensus that PD programs situated at the workplace are more fruitful, there is (still) no empirical evidence that supports this consensus. Also, the research into individual PD interventions does not show specific designs to be more effective than others (Garet et al., 2001; Smith & Gillespie, 2007). Teacher effects are found for both more traditional and innovative designs (e.g., 1-day courses and visiting lectures at conferences) as well as for more innovative designs (e.g., coaching and study groups).

What seems to be more relevant is the perceived relevance and usefulness of the program with respect to teachers' daily work: "Quality professional development engages teachers in inquiry about the concrete tasks of teaching, assessment, observation, and reflection, and provides them with the opportunity to make connections between their learning and their classroom instruction" (Borko et al., 2010, p. 549). There is hardly any research that demonstrates that this qualitative PD can only be realized 'on-site' or only within innovative designs of PD programs.

## Content Focus

An effective feature of PD programs that appears in many studies—and is even considered most relevant in some studies—is the content focus of the program. The content of the intervention should be related to classroom practice, more specifically to subject content, pedagogical content knowledge and student learning processes of a specific subject. When teachers develop with respect to these aspects of content, an increase in teacher quality and student learning results. This is in line with findings from research into features of effective teachers. Effective teachers master the subject content and are capable of explaining this content to students in a way that students do understand and learn (Scherer & Bosker, 1997).

In addition, understanding the processes of student learning increases the quality of education and student achievement. For instance, in a more

*What Makes Teacher Professional Development Effective?* 13  
results in order to get more insights into how their students learned and understood the content.

### *Quality of the Content Provided*

Multiple studies underpin the need for the provision of theory-based content and well-researched (evidence-based or evidence-informed) methods and practices (Buczynski & Hansen, 2010; Bierman et al., 2008; Domitrovich et al., 2009; Yoon et al., 2007). Examples of learning and teaching in a PD program should be powerful and clear, intellectually challenging, and exceptional (not a routine example) (Knapp, 2003). Furthermore, there should be a provision of permanent access to newly developed knowledge and expertise of colleagues within and outside the teacher's own school (Little, 2006).

### *Active and Inquiry-Based Learning*

Another critical feature has to do with the actual activities teachers should undertake in PD programs. In almost all studies, opportunities for teachers to take part in active learning link to effective PD. Active learning, as opposed to passive learning (e.g., listening to a lecture), takes form in observing expert teachers or being observed by other teachers followed by feedback and discussion, or reviewing student work. Nowadays, active learning is more and more understood as similar to inquiry-based learning. Almost all studies report on 'inquiry-based' elements incorporated in the design of the PD program. Those elements range from analyzing student data, performing research activities with respect to practice-related content such as student work, learning problems of students or innovative curricula. In these studies, inquiry-based activities do not necessarily mean that teachers are actually performing research themselves—as is the case in developments as the 'teacher as researcher.' Rather, teachers are actively engaged in order to learn in the context of the PD program.

### *Collective Participation*

A feature closely connected to active learning is collective participation and collaborative teacher learning. It concerns collaborations between teachers from the same school, grade or department. "Such arrangements set up potential interaction and discourse, which can be a powerful form of teacher learning" (Desimone, 2009, p. 184). Another aspect of collective participation emphasized in literature on professional learning communities is the importance of a shared responsibility of the teachers for their own PD (Little, 2006). Teachers need to be involved in setting the goals of a PD program but also in choosing content and design of the PD intervention (Hawley & Valli, 1999) in order to increase both the effectiveness as well as the usefulness of the PD program.



### *ation and Sustainability*

Other feature often mentioned with respect to effective PD is duration: research shows that intellectual and pedagogical change requires PD activity to be of sufficient duration, including both span of time over which the activity is spread (e.g. 1 day or one semester) and the number of hours spent in activity" (Desimone, 2009, p. 184). It is difficult to identify an exact 'tip-off point' since it always depends on the type of activity. Findings from the review of Yoon and colleagues (2007) show support for at least 14 hours of training. Desimone (2009) comes up with a minimum of 20 hours, but Suppaz and Turner (2000) indicate a minimum of 80 hours of training for teacher behavioral change to occur. On the other hand, research from Telese (2008) shows that too many hours of PD can be ineffective. What all these studies agree on is that a substantial amount of time (both span of time and total hours) is necessary in order for PD to be effective.

In many studies work pressure is a frequently mentioned problem related to PD. Often there seems to be too little time for development. There will be further discussion of this problem in the section on school organizational conditions. A different aspect of duration has to do with the notion of sustainability of the intervention (cf. Desimone, 2009; Yoon et al., 2007). This means that one-shot, short-term interventions might be less effective than long-term interventions combined with enduring follow-up support (i.e., follow-up interventions, permanent support of group collaboration and ongoing facilitation of teacher learning).

### *Coherence*

A feature increasingly emphasized in the literature is coherence: "the consistency of school, district and state reforms and policies, with what is taught in PD" (Desimone, 2009, p. 184). This might prevent the PD program from becoming perceived as an isolated endeavor in the school and therefore help to improve the sustainability of the effects of the program. Another important aspect of coherence is the extent to which the goals, content and design of the PD program are consistent with teachers' knowledge and beliefs. Knapp (2003) advises linking PD to ongoing innovations, but also to specific problems the teachers experience in their daily work, including external pressure most innovations bring along (cf. Blank & de las Alas, 2009; Borko et al., 2010; Desimone, 2009; Hawley & Valli, 1999; Little, 2006; Smith & Gillespie, 2007; Timperley et al., 2007).

### *Theory of Improvement*

Recent research shows more and more support for the necessity of a well-defined and explicit understanding of the relation between specific features of learning goals, the theory of

*What Makes Teacher Professional Development Effective?* 15

improvement.' This understanding must comprise both teacher learning ('theory of change') as well as student learning ('theory of instruction') (Desimone, 2009; Yoon et al., 2007).

### *Organizational Conditions*

In a limited number of studies on teacher learning, school organizational conditions that contribute to the success and sustainability of a PD intervention are included. In most studies on effective teacher PD this is not the central focus. They merely focus on the relation between features of the intervention and the effectiveness in terms of teacher or student learning. The school organizational dimension was also neglected in most studies on teacher PD. The same applies, however, for school organizational research on learning in the workplace, organizational learning and professional learning communities, in which insights from research on teacher PD are hardly used. Recently, this seems to be changing (e.g., Smylie, 1995; Imants & van Veen, 2010).

Some studies point to the importance of leadership or creating a professional learning community in general (cf. Desimone, 2009; Ermeling, 2010; James & McCormick, 2009; Timperley et al., 2007). Other studies argue that a sufficient amount of time is important (Buczynski & Hansen, 2010; Lee et al., 2004; Norton & McCloskey, 2008; Stark, 2006; Vogt & Rogalla, 2009; Wilson, 2008), but they almost never elaborate on the implications of such conditions for the daily schedule of a school and teachers' workload.

The feature that an intervention should be consistent with the school, district or state policy should also be incorporated with school organizational conditions.

A few studies discuss school organizational conditions in more detail. For example, Smith and Gillespie (2007) extensively describe the culture and structure of the organization, the working conditions for teachers and schoolwide expectations and incentives to use new teaching practices. Also, Little (2006) discusses rather extensively the importance of a culture in which teachers themselves and school management consider teacher learning relevant. Little also stresses the importance of leadership and a shared focus of teachers on vision, responsibility, decisions, working and learning.

Other examples are Zwart et al. (2009), who in the context of peer-coaching interventions point to the significance of a safe learning culture in the school and the problem of relatively short periods in a year that teachers have time to learn. Holmlund Nelson and Slavic (2007) also refer to this problem when they point out that executing a research cycle often does not coincide with the duration of a school year. In this context, Ermeling (2010) stresses the importance of "dedicated and protected times to meet on a regular basis to get important work done."

In research on professional learning communities, developing and having a shared vision, shared responsibility, shared approach, shared reflection

[illegible]

ent learning than teacher learning. In general, school culture and structure place less emphasis on teacher learning simply because student learning and achievement are the primary concern. School organization literature and research on learning at the workplace, organizational learning and professional learning communities provide some valuable suggestions and ideas for this purpose. In research on organizational learning, for example, concepts like leadership, organizational climate, teacher collaboration and agency are elaborated (Slegers & Leithwood, 2010). In research on learning at the workplace five factors are distinguished:

1. the learning potential of the task
2. possibilities for feedback, evaluation and reflection on activities
3. formalizing work processes
4. teacher participation in dealing with problems and designing and developing work processes
5. learning resources (Ellström, 2001; Imants & van Veen, 2010)

It is important to note that these organizational features are not objective factors, but they are defined by the way in which teachers and school leaders make sense of these conditions (Imants & van Veen, 2010; Slegers & Leithwood, 2010).

These organizational conditions primarily show that attending to teacher learning in schools requires a different way of thinking, namely, taking the structural and cultural possibilities and constraints for teacher learning in the entire organization into consideration. This can have far-reaching implications, which if not taken into consideration, may explain

The central aim of this chapter was to provide an overview of what is currently known about the effectiveness of teachers' PD programs or PD interventions on the effectiveness of teachers, the quality of their teaching and student learning. The chapter is based on a systematic exploration of empirical studies on the effects of divergent PD interventions.

A first set of conclusions refers to the nature of the current research on effective teacher PD. Some problems exist that complicate the conclusions on what works. Besides some methodological and conceptual issues, the most urgent problem is the overload of (mostly qualitative) studies that examine one program or intervention in one specific setting. Fewer studies examine one specific intervention in several settings or several interventions in several settings, with different coaches. Such studies are necessary to draw valid, reliable and generalizable conclusions. Apparently, no rigid conclusions can be drawn on 'what works' in PD interventions or on specific interventions. What remains possible, however, is to describe what is known about effective features of PD in general, which should be regarded as *indications* for what works.

A second set of conclusions refers to the effective features of teacher PD. The most relevant and striking feature refers to the content: It is important to focus on the daily teaching practice, more specifically, the subject content, the subject pedagogical content knowledge and the students' learning processes of a specific subject. Furthermore, there is still hardly any research showing that PD situated in the workplace would be more effective than offsite PD. Other relevant features are active and inquiry-based learning, collegial learning, a substantial amount of time, cohesion with the school policy and or national policy and at the same time a congruence with the problems teachers experience in their daily teaching practice. In the case of all of these features, a theory of improvement is relevant: knowing how the specific features stimulate the learning of teachers and/or their students. Finally, it is relevant to consider the school organizational implications to ensure that the PD is relevant, successful and sustainable. Schools are mainly designed for student learning and for teachers to work, rather than for teachers to learn.

To conclude, there seems to be a large degree of conceptual saturation regarding the effective features in general. What is lacking is a more precise



rationalization of these effective features in specific situations and contexts. Furthermore, the set of effective features described in this chapter as a need for well-designed PD interventions, in which teachers' learning goals and their daily teaching practice are central, teachers are actively involved in the learning process and are sustainable over time. In other words, there is a strong need for teacher learning that matters. The following chapters provide examples of such interventions.

## REFERENCES

- Aiken, L., Vermunt, J. D. & Wubbels, T. (2010). Teacher learning in the context of educational innovation: Learning activities and learning outcomes of experienced teachers. *Learning and Instruction*, 20, 533-548.
- Arman, K. L., Domitrovich, C. E., Nix, R. L., Gest, S. D., Welsh, J. A., Greenberg, M. T., Blair, C., Nelson, K. E. & Gill, S. (2008). Promoting academic and social-emotional school readiness: The Head Start REDI Program. *Child Development*, 79(6), 1802-1817.
- Dehaene, S. (2007). Why 'what works' won't work: Evidence-based practice and the democratic deficit in educational research. *Educational Theory*, 57(1), 122.
- Frank, R. K., & de las Alas, N. (2009). *Effects of teacher professional development on gains in student achievement: How meta analysis provides scientific evidence useful to education leaders*. Washington, DC: Council of Chief State School Officers.
- Groen, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher*, 33(8), 3-15.
- Groen, H., Jacobs, J. & Koellner, K. (2010). Contemporary approaches to teacher professional development. In E. Baker, B. McGaw & P. Peterson (Eds.), *International encyclopedia of education* (3rd ed.) (pp. 548-555). Oxford: Elsevier Scientific Publishers.
- Groen, A. S. (2010). Organizing schools for improvement. *Phi Delta Kappan*, 91(7), 23-30.
- Groen, A. S., Sebring, P. B., Allensworth, E., Luppescu, S. & Easton, J. Q. (2010). *Organizing schools for improvement. Lessons from Chicago*. Chicago / London: University of Chicago Press.
- Buczyński, S., & Hansen, C. B. (2010). Impact of professional development on teacher practice: Uncovering connections. *Teaching and Teacher Education*, 26, 599-607.
- Butler, D. L., Lauscher, H. N., Jarvis-Sellinger, S. & Beckingham, B. (2004). Collaboration and self-regulation in teachers' professional development. *Teaching and Teacher Education*, 20, 435-455.
- Chamberlin, M. T. (2005). Teachers' discussions of students' thinking: Meeting the challenge of attending to students' thinking. *Journal of Mathematics Teacher Education*, 8, 141-170.
- Clarke, & Hollingsworth, (2002). Elaborating a model of teacher professional growth. *Teaching and Teacher Education*, 18(8), 947-967.
- Cohen, D., & Hill, H. C. (2000). Instructional policy and classroom performance: The mathematics reform in California. *Teachers College Record*, 102, 296-345.
- Cohen, D., Raudenbush, S., & Ball, D. (2003). Resources, instruction, and research. *Educational Evaluation and Policy Analysis*, 25(2), 1-24.
- Deimone, L. M. (2009). Improving impact studies of teachers' professional

- Deimone, L. M., Porter, A. C., Garet, M. S., Yoon, K. S. & Birman, B. F. (2002). Effects of professional development on teachers' instruction: results from a three-year longitudinal study. *Educational Evaluation and Policy Analysis*, 24, 81-112.
- Domitrovich, C. E., Gest, S. D., Gill, S., Bierman, K. L., Welsh, J. A. & Jones, D. (2009). Fostering high-quality teaching with an enriched curriculum and professional development support: The Head Start REDI Program. *American Education Research Journal*, 46(2), 567-597.
- Doppel, Y., Schuna, C. D., Silk, E. M., Mehalik, M. M., Reynolds, B. & Ward, E. (2009). Evaluating the impact of a facilitated learning community approach to professional development on teacher practice and student achievement. *Research in Science & Technological Education*, 27(3), 339-354.
- Ellström, P. E. (2001). Integrating learning and work: Problems and prospects. *Human Resource Development Quarterly*, 12, 421-435.
- Elmore, R. F. (2005). Building new knowledge: School improvement requires new knowledge, not just good will. *American Educator*, 29(1), 20-27.
- Ernstling, B. A. (2010). Tracing the effects of teacher inquiry on classroom practice. *Teaching and Teacher Education*, 26, 377-388.
- Fishman, B. J., Marx, R. W., Best, S. & Tal, R. T. (2003). Linking teacher and student learning to improve professional development in systemic reform. *Teaching and Teacher Education*, 19, 643-658.
- Frank, M. L., Carpenter, T. P., Levi, L. & Fennema, E. (2001). Capturing teachers' generative change: A follow-up study of professional development in mathematics. *American Educational Research Journal*, 38(3), 633-689.
- Garet, M. S., Cronen, S., Eaton, M., Kurki, A., Ludwig, M., Jones, W., Uekawa, W., Falk, A., Bloom, H. S., Doolittle, F., Zhu, P., Szejnberg, L., & Silverberg, M. (2008). *The impact of two professional development interventions on early reading instruction and achievement*. Washington, DC: National Center for Educational Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.
- Garet, M. S., Porter, A., Deimone, L., Birman, B. & Yoon, K. S. (2001). What makes a professional development effective? Results from a national sample of teachers. *American Education Research Journal*, 38(4), 915-945.
- Guskey, T. R. (2000). What makes professional development effective? *Phi Delta Kappan*, 80, 748-750.
- Guskey, T. R., & Sparks, D. (2004). Linking professional development to improvements in student learning. In E. M. Givron, J. R. Dangel & I. A. Dubuque (Eds.), *Teacher education yearbook XII: Research linking teacher preparation and student performance* (pp. 11-22). Dubuque, IA: Kendall/Hunt.
- Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York: Routledge.
- Hawley, W., & Valli, L. (1999). The essentials of effective professional development: A new consensus. In L. Darling-Hammond & G. Sykes (Eds.), *Teaching as the learning profession: Handbook of policy and practice* (pp. 127-150). San Francisco: Jossey-Bass.
- Hofman, R. H., & Dijkstra, B. J. (2010). Effective teacher professionalization in networks? *Teaching and Teacher Education*, 26, 1031-1040.
- Holmlund Nelson, T., & Slavic, D. (2007). Collaborative inquiry among science and mathematics teachers in the USA: Professional learning experiences through cross-grade, cross-discipline dialogue. *Journal of In-service Education*, 33(1), 23-39.
- Imants, J., & van Veen, K. (2010). Teacher learning as workplace learning. In E. Baker, B. McGaw & P. Peterson (Eds.), *International Encyclopedia of Education* (3rd ed.) (pp. 569-574). Oxford: Elsevier Scientific Publishers.
- Ingvarson, L., Meiers, M. & Beavis, A. (2005). Factors affecting the impact of professional development programs on teachers' knowledge, practice, student

nes, M., & McCormick, N. (2007). *Teacher learning in mathematics: Using student and Teacher Education*, 25, 973-982.

zemi, E., & Franke, M. L. (2007). Reacting student work to promote collective inquiry. *Journal of Mathematics Teacher Education*, 7, 201-235.

Medy, M. (1998). *Form and substance of in-service teacher education*. Madison: National Institute for Science Education.

University of Wisconsin-Madison, National Institute for Science, Technology, and Policy Studies, 480 Lincoln Drive, Madison, WI 53706, USA. E-mail: [ms@facstaff.wisc.edu](mailto:ms@facstaff.wisc.edu)

Research in Education, 2, 103-137.

5. O., Hart, J. E., Chevas, P. & Enders, C. (2004). Professional development in inquiry-based science for elementary teachers of diverse student groups. *Journal of Research in Science Teaching*, 41(10), 1021-1043.

of Research in Science Teaching, 38(1), 1-10.

McClellan, J. C. (2010). How the structure and focus of teachers' Urban elementary school teachers' knowledge and practices in teaching science to English language learners. *Journal of Research in Science Teaching*, 41(10), 1021-1043.

1021-1043.  
evine, T. H., & Marcus, A. S. (2010). How the structure and focus of teachers' collaborative activities facilitate and constrain teacher learning. *Teaching and Teacher Education*, 26, 389-398.

Teacher Education, 26, 389-398.

learning-centered school. Arlington, VA: Educational Resources Service Center.

Rucks-Horsley, S., & Matsumoto, C. (1999). Research on professional development for teachers of mathematics and science: The state of the scene. *School Science and Mathematics, 99*(5), 258-271.

Science and Mathematics, 1975-1980. In *Journal of Curriculum Studies*, 17(1), 1-10.

McCutcheon, D., Abbott, R. D., Green, L. B., Bercavas, S. N., Cox, S., Potter, N. S., Quinoga, T. & Gray, A. L. (2002). Beginning literacy: Links among teacher knowledge, teacher practice, and student learning. *Journal of Learning Disabilities*, 35(1), 69-86.

Morge, L., Toczek, M. & Chakroun, N. (2010). A training programme on mathematics abilities, 35(1), 69–86.

pupils' achievement. *Teaching and Teacher Education*, 20, 120-130.

Norton, A. H., & McCloskey, A. (2008). Teaching experiments and professional development. *Journal of Curriculum Studies*, 40(1), 285-305.

development. *Journal of Mathematics Teacher Education*, 22(1), 17-27.

Porte, P., Ax, J., Beijaard, W. & Wubbels, T. (2004). Teachers' development of professional knowledge through action research and the facilitation of this by professional knowledge. *Teacher Education*, 20, 571-588.

Raudenbush, S. W. (2005). Learning from attempts to improve schooling: The contribution of methodological diversity. *Educational Researcher*, 34(2.5), 25-31.

Saxe, G. B., Gearhart, M. & Nasir, N. S. (2001). Enhancing students' understanding of mathematics: A study of three contrasting approaches to professional

support. *Journal of Mathematics Teacher Education*, 7, 22-32.

Scheerens, J., & Bosker, R. J. (1997). *The foundations of educational effectiveness*. Oxford: Elsevier Science Publishers.

Oxford: Elsevier Science Publishers.

Secada, W. G., & Adajian, L. B. (1997). Mathematics teachers' change in the context of their professional communities. In E. Fennema & B. S. Nelson (Eds.), *Teachers' lives in Transition* (pp. 193-219). Mahwah, New Jersey: Lawrence Erlbaum Associates.

Lawrence Erlbaum Associates.

Slavin, R. (2008). Perspectives on evidence-based research in education. *Educational works? Issues in synthesizing educational program evaluations*. *Educational*

Researcher, 37(1), 5-14.

*Researcher*, 37(1), 5–14.

Sieegers, P., & Leithwood, K. (2010). School development for teacher learning and change. In E. Baker, B. McGaw & P. Peterson (Eds.), *International Encyclopedia of Education* (3rd ed.) (pp. 557–561). Oxford: Elsevier Scientific Publishers.

Smith, C., & Gillespie, M. (2007). Research on professional development and teacher change: Implications for adult basic education. *Review of Adult Learning and Literacy*, 7, 205-244.

ing and Literacy, 1, 203-244.  
Smylie, M. A. (1995). Teacher le-

Smyle, M. A. (1995). Teacher learning in the workplace: Implications for school reform. In T. R. Guskey & M. Huberman (Eds.), *Professional development in education: New paradigms and practices* (pp. 92-113). New York: Teachers College Press.

Sark, S. (2006). Using action learning for professional development. *Educational Action Research*, 14(1), 23-43.

Supovitz, J. A. (2001). *Translating teaching practice into improved student achievement*. Chicago: University of Chicago Press.

Supovitz, J. A., & Turner, H. M. (2000). The effects of professional development on science teaching practices and classroom culture. *Journal of Research in Science Teaching*, 37(9), 963-980.

Talbot, J. A. (2008). Teacher professional development in mathematics and student achievement: A NAEP 2005 analysis. Paper presented at the annual meeting of the school science and mathematics association.

Tienken, C. H., & Achilles, C. M. (2003). Changing teacher behavior and improving student writing achievement. *Planning and Changing*, 34, 153-168.

Timperley, H., Wilson, A., Barrar, H. & Fung, I. (2007). *Teacher professional learning and development. Best evidence synthesis iteration (BES)*. Wellington: Ministry of Education.

Verloop, N. (2003). De leraar [The teacher]. In N. Verloop & J. Lowyck (Eds.), *Onderwijskunde, een kennisbasis voor professionals* [Educational studies, a knowledge base for professionals] (pp. 194–249). Groningen/Houten: Wolters-Noordhoff.

Vescio, V., Ross, D. & Adams, A. (2008). A review of research on the impact of professional learning communities on teaching practice and student learning. *Teaching and Teacher Education*, 24, 80-91.

Vogt, F., & Rogalla, M. (2009). Developing adaptive teaching competency through coaching. *Teaching and Teacher Education*, 25, 1051-1060.

Wallace, M. R. (2009). Making sense of the links: Professional development, teacher practices, and student achievement. *Teachers College Record*, 111(2), 573-596.

Wayne, A. J., Yoon, K. S., Zulu, P., Cronen, S., & Garet, M. S. (2008). Experimenting with teacher professional development: Motives & methods. *Educational Researcher*, 37(8), 469-479.

Wilson, N. S. (2008). Teachers expanding pedagogical content knowledge: Learning about formative assessment together. *Journal of In-service Education*, 34(3), 283-289.

Yoon, K. S., Duncan, T., Lee, S. W. Y., Scarloss, B. & Shapley, K. (2007). *Reviewing the evidence on how teacher professional development affects student achievement* (Issues & Answers Report, REL 2007-No.033). Washington, DC: Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southwest.

Zwart, R. C., Wubbels, T., Bergen, Th. & Bolhuis, B. (2009). Which characteristics of a reciprocal peer coaching context affect teacher learning as perceived by teachers and their students? *Journal of Teacher Education*, 60(3), 243-257.